WWHK
Werkstoffkunde & Werkstoffprüfung
Materials Science & Materials Testing

Hochschule Kaiserslautern
University of Applied Sciences

Design and construction of a recycling line for waste generated during the FDM process

Fused deposition modelling (FDM) and 3D printing in general generate significant amounts of plastic waste. This waste results from support structures, brims, rafts, misprints, prototype trials or overflows during colour changes. Such waste is often discarded, even though thermoplastic materials such as PLA or PETG are recyclable in principle. In view of growing sustainability requirements and material costs, it therefore makes sense to develop ways of returning this waste to the recycling cycle. The aim is therefore to design and prototype a system that converts 3D printing waste into a new, printable filament, thus offering both ecological and economic advantages.

One option is to convert the waste back into filament. This requires a multi-stage process: first, the waste must be collected, sorted and shredded into small, uniform pieces using a shredder. This is followed by cleaning and drying, as contaminants and moisture can have a negative impact on subsequent extrusion. In the core process, the processed particles are melted in an extruder and formed into a filament strand through a nozzle. This requires precise control of temperature, material flow and drawing speed in order to reliably maintain the desired diameter. In addition, integrated measurement and control systems are to ensure quality assurance. Finally, the filament is wound onto spools and made available for reuse.

The aim of the student project is to develop a compact system that can be used to recycle 3D printing waste into new filament. The focus is on the design and implementation of a functional prototype that integrates the essential process steps of shredding, cleaning, drying, extrusion, quality control and winding. The system should be capable of processing common printing materials such as PLA and PETG while producing filament with a consistent diameter. In addition to technical functionality, aspects such as user-friendliness, safety, energy efficiency and sustainability must be taken into account. The work should thus make a practical contribution to resource conservation and show how waste material can be turned into a high-quality starting product for 3D printing.

Type of assignment:
The scope will be adjusted according to the type of student work.
Group work is also welcome.

- Practical study phase
- Practical phase + bachelor's thesis
- Master's thesis
- Research & development module

Duration: According to the PO and type of student work.
Start: Immediately